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## *VIRAL HEPATITIS IN THE U.S. MILITARY: A STUDY OF HOSPITALIZATION RECORDS FROM 1974 TO 1999*

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# Viral Hepatitis in the U.S. Military: A Study of Hospitalization Records from 1974 to 1999

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Viral hepatitis remains a health threat for military forces. Most recently, there has been concern about hepatitis C virus transmission during military service because a high prevalence of hepatitis C virus infection has been found in some U.S. veteran populations. In this study, hospitalizations of active duty U.S. military personnel for hepatitis were evaluated using standardized computer records. Only the first hospitalization was assessed during the period January 1, 1989, to December 31, 1999. Among active duty forces, the rate of hospitalization for all types of acute hepatitis declined from 13 to 1.1 per 100,000 personnel from 1989 to 1999. Males, nonwhite racial/ethnic groups, and older troops were more likely to be hospitalized for acute hepatitis. This study's finding of declining rates of acute hepatitis is a continuation of a trend observed since 1974. The decreasing risk of viral hepatitis in the U.S. military is attributable to several factors, including reduced levels of injection drug use because of routine, randomized drug testing.

## Introduction

Viral hepatitis remains a health threat for military forces. Because there are diverse routes of transmission, the risk of viral hepatitis cannot be completely eliminated. Hepatitis A transmission is facilitated by the military environment, including crowded living conditions, the difficulty of maintaining high levels of sanitation during operational deployments, and increased exposure in developing countries.<sup>1</sup> Hepatitis B was a problem among U.S. military forces during a previous period of increased drug use in the 1960s and 1970s and continues to be a concern because of sexual transmission.<sup>2,3</sup>

More recently, hepatitis C virus (HCV) infection has been considered a potential health threat for military personnel and veterans from illicit drug use, prior blood transfusions, and contact with the blood of battlefield casualties.<sup>4,5</sup> Hepatitis E, which is transmitted via the fecal-oral route, is a potential problem in developing countries from consumption of contaminated water and food.<sup>6</sup>

In this study, the incidence of hospitalizations for hepatitis among all active duty U.S. military personnel was evaluated for the years 1989 to 1999. This investigation is a continuation of previous studies of U.S. military forces that began in 1974.<sup>7,8</sup> Because active duty military members infrequently obtain medical care for serious illness outside the military health system, this study provides an indication of the health risk posed by viral hepatitis among U.S. military forces.

## Methods

For this study, routinely collected data on military hospitalizations were obtained from the Standard Inpatient Data Record (SIDR). The SIDR is a computerized database of standardized discharge records for hospitalizations within the military health system, which ensures uniform data collection across the military services. The SIDR file contains data since October 1, 1988, for all inpatient health care provided worldwide in U.S. military treatment facilities. Social Security numbers and family member prefixes are used to track sponsors (service members) and their dependents within the system.

The SIDR contains a summary of discharge information, including date of admission and discharge, up to eight procedural codes, and up to eight individual discharge diagnoses for each hospitalization. Specific diagnoses are currently coded according to the International Classification of Diseases Adapted, Ninth Revision (ICDA-9). The SIDR also captures basic demographic data, such as age, sex, race/ethnicity, and rank.

All active duty personnel admitted as inpatients to military treatment facilities were evaluated for the period January 1, 1989, through December 31, 1999. Only the first hospitalization for hepatitis was assessed when a patient was admitted more than once during the study period.

The ICDA-9 classifications used in this study for acute hepatitis, chronic hepatitis, and cirrhosis are listed in Table I. The following demographic variables were used in the analysis: age, gender, race/ethnicity, rank, and service branch. Also evaluated was history since 1989 of hospitalization within a military treatment facility that included either a primary or a secondary discharge diagnosis of a sexually transmitted disease (STD; ICDA-9 091 through 099) or illicit drug use (ICDA-9 304 and 305.2 through 305.7).

A master record file of military personnel is maintained by the Naval Health Research Center in San Diego, California. This file provided average annual population estimates for all active duty personnel. In the total active duty force, the population size ranged from a high of 2,130,229 individuals in 1989 to a low with military downsizing of 1,406,830 in 1998 and 1,370,963 in 1999.

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This study was conducted in accordance with the Department of the Navy's Protection of Human Subjects guidelines and applicable federal regulations governing the protection of human subjects in research.

The views expressed in this article are those of the authors and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

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TABLE I  
ICDA-9 CODES USED IN ANALYSIS OF HOSPITALIZATION DATA

Acute hepatitis	
Hepatitis A	
070.0	Viral hepatitis A with hepatic coma
070.1	Viral hepatitis A without mention of hepatic coma
Hepatitis B	
070.2/20/21	Viral hepatitis B with hepatic coma
070.3/30/31	Viral hepatitis B without mention of hepatic coma
Hepatitis C	
070.41	Acute or unspecified hepatitis C with hepatic coma
070.51	Acute or unspecified hepatitis C without mention of hepatic coma
Hepatitis unspecified	
070.42	Hepatitis delta
070.43	Hepatitis E with hepatic coma
070.49	Other specified viral hepatitis with hepatic coma
070.52	Hepatitis delta without mention of active hepatitis B disease or hepatic coma
070.53	Hepatitis E without mention of hepatic coma
070.59	Other specified viral hepatitis without mention of hepatic coma
070.6	Unspecified viral hepatitis with hepatic coma
070.9	Unspecified viral hepatitis without mention of hepatic coma
Chronic hepatitis	
070.22/23	Viral hepatitis B with hepatic coma
070.32/33	Viral hepatitis B without mention of hepatic coma
070.44	Chronic hepatitis C with hepatic coma
070.54	Chronic hepatitis C without mention of hepatic coma
571.40	Chronic hepatitis, unspecified
571.41	Chronic persistent hepatitis
571.49	Other chronic hepatitis
Cirrhosis	
571.5	Cirrhosis of liver without mention of alcohol

For this study, annual rates of hospitalization were standardized by age and sex using the direct method based on population estimates of the U.S. military force. To calculate 95% confidence intervals (95% CI), the standard normal approximation to the binomial distribution was used with an  $\alpha = 0.05$  probability.

Computerized hospital discharge data are also available for the U.S. Navy beginning in 1974. To evaluate long-term secular trends in hospitalization for viral hepatitis, recent SIDR data were compared with previous studies of naval personnel for the years 1974 to 1988.<sup>7,8</sup>

## Results

Among active duty military forces, the rate of hospitalization for all types of acute hepatitis declined from 13.1 per 100,000 personnel (95% CI, 11.5–14.6) to 1.1 per 100,000 (95% CI, 0.5–1.6) between 1989 and 1999 (Table II). Among specific kinds

of acute hepatitis, there was a decreasing rate of hospitalization for hepatitis A and for hepatitis of "unspecified" type during this 11-year period (Table II). The rate of admissions for acute hepatitis B also decreased from 1992 to 1999. Hospitalizations for acute hepatitis C increased greatly after the introduction of a serological test for this infection in 1991 but began decreasing in 1995. By 1999, the rate of hospitalization for acute hepatitis C had decreased to 0.2 cases per 100,000 military personnel.

A number of demographic factors were associated with hospitalization for acute hepatitis. During the period 1989 to 1999, the overall rate per 100,000 personnel for all types of acute hepatitis was higher among men (8.2; 95% CI, 6.8–9.7) than women (6.3; 95% CI, 2.8–9.7). For the same period, the overall rate per 100,000 was 8.2 (95% CI, 5.1–11.2) for African Americans, 7.3 (95% CI, 2.4–12.2) for Hispanics, and 6.3 (95% CI, 4.9–7.7) for whites. Younger military personnel were at slightly decreased risk of hospitalization for acute hepatitis: 7.2 per 100,000 (95% CI, 5.3–9.2) among troops 26 years of age or younger compared with 8.6 per 100,000 (95% CI, 6.7–10.5) among older military personnel.

For acute hepatitis, the overall rates of hospitalization per 100,000 were the same across service branches: Army (8.0; 95% CI, 5.8–10.1), Navy (8.0; 95% CI, 5.5–10.4), Marines (8.0; 95% CI, 3.6–12.3), and Air Force (8.0; 95% CI, 5.0–10.9). Officers had a similar risk of hospitalization for all types of acute hepatitis (8.0 per 100,000; 95% CI, 3.6–12.4) as enlisted personnel (7.9 per 100,000; 95% CI, 6.6–9.4).

Compared with all other military inpatients, patients hospitalized with a diagnosis of acute hepatitis were at higher risk of having been hospitalized sometime during the 11-year period of this study with a primary or secondary discharge diagnosis of a STD or illicit drug abuse. Among patients hospitalized for acute hepatitis, 1.4% also had a diagnosis of a STD compared with 0.02% of other inpatients. Additionally, 1.3% of patients with acute hepatitis had a diagnosis of illicit drug use compared with 0.05% of all other military inpatients.

The rates of hospitalization for chronic hepatitis and non-alcohol-related cirrhosis increased from 1989 until 1995 but then decreased sharply (Table III). In 1999, there were only eight hospitalized cases of chronic viral hepatitis and three cases of cirrhosis among actively serving military personnel.

## Discussion

As shown in this study, there has been a trend during the last decade of decreasing hospitalizations for acute hepatitis in the U.S. military. This downward trend is a continuation of decreasing rates observed in previous studies of U.S. military forces. For acute hepatitis, the rates of hospitalization per 100,000 Navy personnel were 160 in 1974,<sup>7</sup> 128 in 1975,<sup>8</sup> and 56 in 1984.<sup>8</sup> By 1989, the rate for all active duty military personnel had decreased to 13 per 100,000 personnel; it continued to decrease to 1.1 per 100,000 in 1999. During this 26-year period, there was a general decline in hospitalizations for all types of acute viral hepatitis, whether transmitted by parenteral, sexual, or fecal-oral routes (Table II).<sup>7,8</sup>

The prolonged trend of decreasing rates of hospitalization for acute hepatitis indicates a decreased risk of viral hepatitis among active duty forces. However, this trend also reflects reduced levels of hospitalization for all types of non-life-threatening

TABLE II

AGE- AND SEX-ADJUSTED HOSPITALIZATION RATES PER 100,000 PERSONNEL FOR ACUTE HEPATITIS AMONG ACTIVE DUTY U.S. MILITARY FORCES, 1989 TO 1999

Year	Acute Hepatitis A		Acute Hepatitis B		Acute Hepatitis C		Acute Unspecified Viral Hepatitis		Total	
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate
1989	178	8.36	3	0.14			99	4.65	278	13.05
1990	113	3.52					75	3.08	187	6.56
1991	74	2.87	25	0.96	1	0.05	72	3.07	168	6.75
1992	44	1.72	94	4.04	52	2.88	39	1.60	224	9.96
1993	34	1.47	57	2.58	68	3.93	35	1.58	194	9.56
1994	26	1.37	37	2.05	73	4.41	17	0.87	149	8.44
1995	37	2.04	25	1.45	35	2.31	18	0.99	115	6.78
1996	33	1.69	17	0.85	15	0.99	18	0.92	83	4.45
1997	10	0.63	6	0.21	10	0.70	14	0.70	40	2.22
1998	6	0.28	7	0.43	4	0.28	10	0.64	27	1.63
1999	4	0.15	7	0.66	2	0.15	1	0.15	11	1.09

ing health problems in both the military and civilian health care systems.<sup>9</sup> Since 1995, substantial changes in hospitalization guidelines within the military health system may have resulted in more patients with viral hepatitis being managed as outpatients, although health care is free and readily available within the U.S. military.<sup>10</sup> Also, the historical imperative to hospitalize military service members to prevent disease transmission in the barracks or workplace has decreased because a higher proportion of the all-volunteer force is married or living off base.

Although there has been a substantial decline in rates of acute hepatitis, the demographic characteristics and risk factors of hospitalized cases have remained similar. For the last 26 years, the risk of acute hepatitis has been higher among men, nonwhite racial/ethnic groups, and military personnel with a history of a STD or illicit drug abuse.<sup>7,8</sup> However, in contrast to previous studies that found a higher rate of acute hepatitis among younger age groups, the present study suggests that younger military personnel were at lower risk in the 1990s.<sup>7,8</sup>

Seroepidemiological studies of U.S. military populations also indicate a low risk of viral hepatitis infection except in certain high-risk groups.<sup>11-13</sup> Hepatitis A is a concern mainly during

deployments to developing countries.<sup>11</sup> The risk of hepatitis B virus infection is low except among STD patients.<sup>3</sup> Importantly, the prevalence of HCV infection has been found to be lower among current active duty forces (0.5%) than in the general population.<sup>14,15</sup> To date, hepatitis E has not been a problem for U.S. military personnel operating in endemic regions.<sup>6</sup> There has never been a documented outbreak of hepatitis E among U.S. forces.

Several factors are responsible for a low and decreasing risk of viral hepatitis within the military. One of the major risk factors for the transmission of viral hepatitis B and C— injection drug use—has been nearly eliminated in the military by routine, randomized drug testing of all military personnel.<sup>16,17</sup> It is noteworthy that the downward trend of hospitalizations for viral hepatitis in the military parallels the downward trend in illicit drug use.<sup>8,18</sup> The testing of all prospective military recruits for illegal drug use and human immunodeficiency virus infection has further reduced the number of military personnel who are at high risk of viral hepatitis. Lastly, the introduction of universal precautions because of the acquired immunodeficiency syndrome epidemic has decreased the risk of hepatitis B and C among medical and laboratory personnel.

The development of the hepatitis B vaccine, and more recently the hepatitis A vaccine, also may have influenced hospitalization rates. Currently, military medical personnel and troops diagnosed with a STD are vaccinated against hepatitis B.<sup>19</sup> Additionally, for the last decade, the hepatitis B vaccine has been recommended for U.S. military members assigned for extended periods of time to embassy guard duty and to the Republic of Korea and other countries with high rates of hepatitis B.<sup>19</sup> The hepatitis B vaccine has not been given routinely to all incoming U.S. recruits, but recruits are now entering military service with preexisting immunity to hepatitis B as a result of national recommendations for adolescent immunization.<sup>20</sup>

In 1995, the hepatitis A vaccine was introduced, which should further reduce the risk of acute viral hepatitis in the U.S. military. The hepatitis A vaccine is being given to incoming recruits, to all deployable military members currently on active duty, and to other troops before deployment to developing countries. Immune globulin is no longer used on a routine basis for prophylaxis against hepatitis A.<sup>19</sup>

TABLE III

AGE- AND SEX-ADJUSTED RATES OF HOSPITALIZATION FOR CHRONIC HEPATITIS AND NON-ALCOHOL-RELATED CIRRHOSIS IN THE U.S. MILITARY

Year	Chronic Liver Disease			
	Chronic Hepatitis		Cirrhosis	
	Number	Rate/100,000	Number	Rate/100,000
1989	83	3.90	6	0.28
1990	81	3.77	12	0.54
1991	107	5.04	7	0.30
1992	146	7.91	5	0.28
1993	107	6.16	12	0.65
1994	122	7.33	9	0.50
1995	139	8.96	13	0.86
1996	87	6.07	3	0.21
1997	27	1.74	2	0.14
1998	18	1.14	2	0.14
1999	8	0.80	3	0.22

Although there is no vaccine for hepatitis C, there has been a reduction in the risk of hepatitis non-A, non-B because of the identification of the HCV in 1989 and the development of serological tests in 1991.<sup>21</sup> Now, HCV is almost never transmitted from transfusion of blood products, which are screened before use.<sup>22</sup> In addition, HCV is not readily transmitted by sexual contact, is not transmitted by casual contact, and would not be transmitted by contact between infected blood and intact skin.<sup>21</sup> In previous studies, HCV infection has not been associated with military deployments or with the use of intramuscular immune globulin.<sup>11,13,23</sup>

The finding of a high prevalence (10–20%) of HCV infection in some studies conducted in Department of Veterans Affairs hospitals may be explained by the unique characteristics of the study populations. The majority of HCV infections have been found among indigent, male patients who were military veterans of the Vietnam War era, a period of both unscreened blood transfusions before HCV testing was possible and increased injection drug use.<sup>24,25</sup> HCV infection has been found infrequently in Department of Veterans Affairs patients who have recently left active military service<sup>5</sup> and among veterans randomly selected from the general population.<sup>15</sup>

Hepatitis A, B, and C infection should not be a major problem for future U.S. military forces as long as current vaccine policies and preventive health measures remain in place. Hepatitis E infection could possibly pose a threat. Hepatitis E is one of the most common types of viral hepatitis in the developing world. However, transmission appears to require a large dose of infectious agent, usually from contaminated drinking water.<sup>26</sup> The military's emphasis on providing potable water and substantial resources to generate clean water by reverse osmosis limits the potential for hepatitis E virus transmission.

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